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REMARKS

The present invention is directed to a cathode structure of the type that can be utilized in an electronic gun of a very compact configuration wherein electron-emitting material can be efficiently heated. Problems have occurred when compacting the size of such cathode structure, wherein electron-emitted material can evaporate and condense on the sides of the cathode structure and can eventually cause a short circuit between electrode leads of the heating wire and a metallic supporting structure.

The present invention addresses this problem and suppresses the amount of evaporated metal material such as barium reaching the electrode leads of a heating wire by increasing the spatial distance that any evaporated electron-emitting material would have to travel while ensuring that the electrode leads extend in a direction away from the desired directional emission of the electrons.

The present invention can use a metal cup, for example of molybdenum in the shape of a cylinder with a bottom, holding a pellet material that can be impregnated with an electron-emitting material such as barium oxide coated with a thin film of an osmium-ruthenium film. Laterally extending wire supports that can cross each other are mounted below the metal cup and are attached to a columnar ceramic heater body having a partially embedded heating wire. The heating wire can be coiled to form an approximately S shape traverse to the axis of electron emission, and thereby assist in compacting the cathode structure. The ceramic body can further have an annular wall extending from its lower surface which surrounds the electrode leads from the heating wire, and thereby increases the flying distance of any barium atoms to the heating wire leads.

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Thus, the wall is configured to serve as a barrier. The end surface of the ceramic body where the heating wire leads out can be further configured in various configurations to increase this flying distance.

The Office Action cited the *Kobayashi et al* (U.S. Patent No. 6,130,502) as completely anticipating Claims 1 and 4-9.

The Office Action cited Figure 7 of the *Kobayashi et al* disclosure, wherein an insulating substrate 21 supported a base metal layer 22 of nickel in the central area of the substrate with an electric terminal lead 22A, shown in Figure 3, extending to one side. A conductive metal layer 22B, also shown in Figure 3, is applied directly to the insulating substrate in order to act as a conductive layer and to adhere it to the substrate.

Finally, a thin circular coating of an electron-emissive material 23 is mounted above the electrode 22A. At the bottom of the insulating substrate, a heater 25 was provided and electrodes 26 were mounted at the edges of the insulating substrate. In the embodiment of Figure 7, the heater could be embedded in an insulating material 36 that is then sandwiched with a reflecting layer 37 to reflect the heat upward. The heating member 25 is preferably formed with a anisotropic pyrolytic graphite. The *Kobayashi et al* reference seeks to reduce power consumption for very compact cathode ray tubes. As can be appreciated, there is no recognition of a potential short circuiting problem associated with barium material being deposited on the heater wire electrodes.

As can be seen, the heater wire electrodes are actually mounted at a perimeter of the substrate. A grid member, shown for example in Figure 10, can be mounted to extend over the electron emission material with an aperture. There is no recognition of any coating problem

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associated with deflection of material by a grid effect. Thus, the *Kobayashi et al* reference is not recognizing nor addressing the same issues resolved in our present invention.

Additionally, it is not directed to a similar cathode structure that would include a metal cup with a pellet embedded in the metal cup and containing electron-emitting material. There is no teaching of mounting wires extending radially outward between the bottom of the metal cup and the ceramic surface of the heater member. These elements are set forth in the amended Claims 1 and 5 and the newly drafted independent Claim 20.

The Office Action also rejected Claims 1-3 and 6 as being anticipated by the *Waltermire* (U.S. Patent No. 3,671,792).

Waltermire was directed to a fast warmup indirectly heated cathode structure, purportedly of the type used in a klystrons or traveling wave tubes intended for airborne or missile systems. Specifically, the Office Action referred to Figure 1 and noted a columnar electric insulating material body 6 with a cathode unit at one end of the body. However, the cathode unit is in fact an inverted refractory cup with a concave surface covered with a layer 3 of nickel carbonyl particles. A very small thickness of the particles, see Column 2, Lines 5-7, are arranged on the concave surface of the cup. A methyl alcohol solution with a low work function material was applied with heat and ultrasonic vibration to the particles, see Column 2, Lines 69-72, to provide electron emissions from the concave surface. The back of the cup included a heater covered with a potting material, which is then fired in a reducing gas atmosphere at a high temperature.

As can be appreciated, it is believed that the service life of the *Waltermire* structure is not addressing the same problems that would occur in a cathode ray tube of a consumer configuration. As noted in Column 3, the cathode structure was placed in diodes and tubes and

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tested only over 100 cycles to try and determine any degradation in the warm up time performance.

Again referring to the amended Claims 1 and 5 and new Claim 20, our particular arrangement of a pellet embedded within a metal cup is not disclosed. In addition, the *Waltermire* strut 7 extends directly from the skirt of the metal cup, and there is no teaching of a plurality of metal wires used as structural elements extending radially outward between a ceramic heater and the bottom of the metal cup.

Finally, the problem addressed in *Waltermire* is to improve an initial response time of electronic tubes which presumably would be an important feature if it was a component in a missile system. There is no recognition of the long-term deterioration of a cathode in a CRT based upon evaporation and condensation of, for example, barium that could short circuit the cathode structure with contact of the heater electrode leads.

The Office Action also rejected Claims 1-3, 6 and 7 as being anticipated by the *Ney* (U.S. Patent No. 3,175,118).

The *Ney* reference discloses a heater cathode assembly operable with small current and power levels. An inverted cup shaped cathode 2 which includes a thermally electron-emissive coating 6 is shown in Figure 2 and Figure 3 and intentionally coats the entire exterior surface of the cup. As can be seen in Figure 1, a leg 10, which apparently can function as a single cathode external lead 18, extends from an edge of the cup immediately adjacent the electron-emissive coating 6. Additionally, the electrode leads of the heater wire 32 are directed radially outward with no recognition of any potential problems of shorting by condensation of alkaline earth metal material.

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The only discussion of a shielding effect is the heat shield 50 that extends across a portion of the bottom of the cup to reflect heat back towards the cup. As can be appreciated, the cup is inverted and holds the heater while the emission material is a surface coating on the bottom of the cup. Again, the *Ney* reference is not recognizing nor addressing the same issues of our present invention, and does not provide a structure of a metal cup with a pellet embedded within the cup in improved the manner defined by our present claims.

The newly drafted dependent Claims 11-19 add additional distinguishing features, while the newly submitted independent Claim 20 provides an alternative definition containing the same distinguishing features mentioned above.

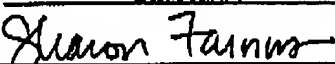
With the amendment of the independent claims and the submission of the new claims, it is believed that the case is now in condition for allowance and early notification of the same is requested.

If the Examiner believes that a telephone interview will help further the prosecution of the case, the undersigned attorney can be contacted at the listed telephone number.

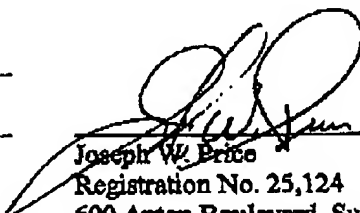
I hereby certify that this correspondence is being transmitted via facsimile to the USPTO at 571-273-8300 on June 22, 2006.

Very truly yours,

SNELL & WILMER L.L.P.

By: Sharon Farnus

Signature

Dated: June 22, 2006


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